DOCUMENT RESUME

ED 231 742 SO 014 982

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TITLE Satellite Telecommunications in Education: An Overview of Related Organizations and Activities.
PUB DATE Jun 83
NOTE 24p.; Paper presented at the Annual Conference of the Social Science Education Consortium, Inc., (20th, Athens, GA, June 8-11, 1983).
PUB TYPE Reports - Descriptive (141) -- Speeches/Conference Papers (150) -- Guides - Non-Classroom Use (055)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Communications Satellites; *Educational Innovation; *Educational Technology; Higher Education; Information Networks; *Organizations (Groups); Technological Advancement; *Telecommunications; Television
IDENTIFIERS Appalachian Education Satellite Project; Public Broadcasting Service; Satellite Instructional Television Experiment

ABSTRACT

An overview is presented of the organizations, institutions, and projects involved in the educational use of satellite communications. This paper is intended for use as a reference tool for educators rather than a means to discuss the implications of satellite communications for individuals and society. A description of the major components of satellite technology is followed by a discussion of 14 satellite related organizations. Examples of satellite based projects for educational purposes are explained, including the Satellite Instructional Television Experiment (SITE), Pan-Pacific Education and Communication Experiments by Satellite (PEACESAT), and Appalachian Education Satellite Project (AESP). Other examples are the University of the South Pacific, the University of the West Indies, Indonesia, and Alaska, all of which currently utilize satellites to supplement, enrich, and establish educational programs; and in the United States, ACSN: The Learning Channel, PBS Adult Learning Department, The Public Service Satellite Consortium, and the National University Teleconference Network, all of which deliver educational programming and experiences. Two projects, the National Committee for Internalizing Education through Satellites (NCIES) and the Wisconsin Classroom Project, are also described. These projects provide direct opportunities in culture and language study, international economics, politics, and world issues across national and cultural boundaries. A listing of existing satellite systems and their current status and a list of contacts are included. (LH)

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Satellite Telecommunications in Education:

An Overview of Related Organizations and Activities

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Paul Schneller

for the conference

"The New Information Technology:

Educational Implication and Social Issues"

The Social Science Education Consortium

June 8-11, 1983, University of Georgia

SP 014 982

Prefatory Note

The original title of this paper was to have been "The Potential of Satellite Telecommunications for Internationalizing Social Science Education." As you can see, the rather grandiose title has been changed, as is often the case when a title has been chosen before much thought and action has been given to preparation of the actual paper. Nevertheless, the long-term goal of the author is still to see satellite telecommunication used in social science education. But rather than provide a theoretical discussion of how that might take place, and because the author is not a social scientist but a communications technology generalist, this paper seeks to encourage social science educators themselves to explore possibilities for becoming involved in the use of satellite telecommunications. Thus the paper identifies some key organizations that might be helpful in the actual development of such use, and it briefly describes some efforts in the educational use of satellite telecommunications that might be models or jumping-off points for developing new applications in the social sciences. Because the paper must be brief, details of these earlier and current efforts are necessarily sketchy. So the names and addresses of contact people are attached to the paper. Readers are encouraged to obtain additional information from these sources.

Satellite telecommunication is an integral part of the new information technology. We--the global "we"--now have the capability to move data, sounds, and images around the world, from one point to another (or to many others) instantaneously. In less than a second, if we had wanted to, we could have presented this meeting "live" to the eyes and ears of people in Angola or Australia, Botswana or Bangladesh, Chile or China, Gabon or Guatemala, Yemen or Yugoslavia, to name but a few of over one hundred other countries now capable of participating in such an event. The technology has been here for years, and it will continue to be refined to become more technically powerful, efficient and available.

Satellite Systems

By now, many of us are familiar with the major components of satellite technology that enable such worldwide communication. Briefly, these components include the following:

- An originating ground station that produces program signals and transmits them to a satellite. The signals transmitted may be audio, video or data. These signals are routed through switchers to a microwave transmitter that produces carrier frequencies and superimposes program signals, then on to a transmitting antenna which directs them to the satellite;

- A satellite with up to 24 channels, or transponders, each capable of carrying different information. The transponder receives a signal (the "uplink") from the originating ground station, changes the signal's frequency so it won't interfere with incoming signals, and redirects the signal (the "downlink") to Earth through its transmitting antenna;

- A receiving ground station that receives the downlink on its antenna, and converts the signal to the original medium of audio, video, or data. The downlink can be received by an appropriately equipped antenna within the transmitting satellite's "footprint." Footprints vary in size, but it is possible to cover most of the Earth with only three satellites spread out appropriately in space above the globe.

At the end of 1982 there were about 500 earth stations providing 1,200 pathways or direct communications links via satellite among 170 countries, territories and areas of independent sovereignty, and more earth stations are being built.[5] (This does not include, of course, the many thousands of "dishes" picking up satellite signals around the globe.)

Satellites are positioned approximately 22,300 miles above the equator. They orbit at the same speed as the Earth spins, so they appear to be stationary (thus, "geostationary orbit," the technology jargon for the movement or positions of these satellites). As you might imagine, satellites are most cost-effective and appropriately used for reaching large numbers of geographically dispersed users. Most satellites currently in use are designed primarily for low-powered, fixed-satellite services, such as radio, television, telephone, telegraph, telex and data. In the planning

stages are higher powered satellites that will be used for direct broadcasting to any location that has the appropriate receiving equipment. (Receivers are now being scaled down in size and up in receiving capabilities.)

Currently, over one hundred satellite communication systems are operational or planned--three international systems, four regional systems, forty-eight dedicated domestic systems, forty-one leased or shared-use domestic systems, nine military systems and fourteen experimental systems. (Figure 1.) In addition to their commercial applications (for which U.S. domestic systems are heavily employed), these systems will be mainly involved in data transmission, meteorology, maritime communications, air navigation and remote sensing (i.e., gathering information in such areas as agriculture, fisheries, forestry, land use, soil surveys, water management, wildlife, rural disaster monitoring, etc.).

Satellite-related International Organizations

In thinking about satellite systems, it is important to be aware of some of the key international organizations that directly or indirectly affect the traffic carried on satellite systems and the costs users may incur.

One of the most well-known and influential organizations is Intelsat, the International Telecommunications Satellite Organization. At the close of 1982, it had 106 member countries. Intelsat owns, maintains and operates satellites for use of all countries--members or not. Its system may be used for international or domestic public telecommunications services. It is a financial cooperative whose ownership is shared by all its member countries. Members contribute to the capital requirements of Intelsat in proportion to investment shares based on their use of the system. After operating expenses, the remaining revenues are shared proportionately among the members. In effect, they pay themselves back. Intelsat's satellite communications business covers telephone, telegram, telex, television, computer data transmission, document facsimiles, and electronic mail, all handled by six satellites: three over the Atlantic Ocean, two over the Indian Ocean, and one over the Pacific. The second segment of Intelsat is the ground segment, hundreds of earth stations around the world that in general are owned by the international telecommunications organizations or postal services of the countries in which the stations are located.[8]

Another international organization in the satellite business is INTERSPUTNIK, the International System and Organization of Space Communications. Its members are Afghanistan, Bulgaria, Cuba, Czechoslovakia, Democratic Yemen, the German Democratic Republic, Hungary, Mongolia, Poland, Romania, the USSR and Viet Nam. It uses two satellites, one over the Atlantic, one over the Indian Ocean, for telephone, telegraph, radio and television programs originated and/or received by thirteen ground stations. Other countries than the members also may use the system.

The European Space Agency (ESA) represents eleven nations in its telecommunications activities: Belgium, Denmark, France, the Federal Republic of Germany, Ireland, Italy, the Netherlands, Spain, Sweden, Switzerland and the United Kingdom. Austria, Norway and Canada are affiliated through

other arrangements. One of ESA's objectives is to set up a network for telephone, television, teleconferences and data transmission. However, their system is not yet operational.

There is also the fledgling ARABSAT, the Arab Satellite Communication Organization, with 21 member Arab states. While they intend to have a system furnishing regional and domestic telephone, telegraph, telex, data transmission and television, both their ground and satellite systems have yet to be established.

The International Telecommunications Union (ITU) is an organization of member countries (approximately 150), headquartered in Geneva. The ITU is over 100 years old. It does not operate a satellite system of its own; rather it convenes world and regional administrative conferences (WARCs and RARCs) at which its members set regulations governing the use of the broadcast spectrum and allocations for satellite orbits. In addition to those responsibilities, the ITU publishes technical information and fosters technical cooperation in telecommunications development and usage. On a day-to-day basis, the ITU is responsible for the management and application of the regulations governing the use of the radio frequency spectrum and the geostationary satellite orbit. Two ITU committees, the International Radio Consultative Committee (CCIR) and the International Telegraph and Telephone Consultative Committee (CCITT) study technical aspects and operating principles for all space services and for interconnecting satellite systems with land systems.[9]

Then there is the United Nations. The UN has a number of committees, subcommittees and divisions concerned with "space activities," as they call them. Some of these have little direct relationship to education, being for scientific, maritime, resources, energy and disaster relief. But others, such as the Outer Space Affairs Division, UNESCO (especially its Division of Methods, Materials and Techniques, and the Center for Science and Technology Division), are playing important roles in developing satellite technology and expanding the involvement of the nations of the world in telecommunications activities. Especially important is the UN Committee on the Peaceful Uses of Outer Space, which is the UN agency taking the lead in coordinating the UN's efforts for international cooperation in the full spectrum of activities involving the uses of outer space, including but not limited to satellite telecommunications.

Another international organization is the International Program for the Development of Communication (IPDC), an effort by several dozen countries to enhance the communication capabilities of the developing world. It is partly supported by UNESCO and partly by voluntary contributions of its members. It has recently funded a number of world-wide, regional and national projects involving radio and television broadcasting, the press, films, telephone and satellite communication, but has little current emphasis on education.

There are a number of other specialized agencies concerned with space and satellite technology: the World Meteorological Organization, the World Health Organization, the International Civil Aviation Organization,

the Inter-governmental Maritime Consultative Organization, the International Atomic Energy Agency, and the World Bank, known less well by its more formal name of the International Bank for Reconstruction and Development, whose Education Department (though small) provides assistance to developing countries for using communication media, including satellites, to upgrade and expand education.

One unique organization, based in the United States but focused internationally, is the Rural Satellite Program, funded by the U.S. Agency for International Development (AID). The Rural Satellite Program is designed to help develop and demonstrate the potential impact of satellite-based communication technologies on Third World development efforts. The Program has centered its efforts on improving the availability of food, health and family planning services, productive work and income opportunities, and access to education. It is currently sponsoring two of the projects that will be described later in this paper, one in the Caribbean and the other in Indonesia.

Educational Uses of Satellites

The extent to which any of the international, regional, or domestic organizations may actively facilitate the educational uses of satellites varies. Educational uses of satellites are certainly not unknown, however. In the last dozen or so years, there have been a number of satellite-based projects for educational purposes. Most of these had brief lives--some a few months or a year; one was only a day's demonstration. Others lasted longer and a few of these are still in operation today. Some examples of the more significant and long-lived are:

- the Satellite Instructional Television Experiment (SITE) in India;
- the Pan-Pacific Education and Communication Experiments by Satellite (PEACESAT) in the Pacific Basin;
- the Appalachian Education Satellite Program (AESP) in the United States.

Satellite Instructional Television Experiment (SITE)

In 1975, India began an experiment to assess the effectiveness of television as an educational medium for its rural population. Programming on national integration, education, health, nutrition, population and agriculture was beamed via satellite to 2,400 remote villages, each having no more than 3,000 inhabitants, in six clusters, one in each of six states. The satellite programs were also rebroadcast, and supplemented by radio, print materials and face-to-face contact. The results of the project were as follows.

Children in TV classrooms showed significant increase in language development; TV apparently did not have the desired effect on school enrollment or absenteeism figures. The average audience for the evening programs was about 100 people per TV set, or about 200,000 nationally, with small farmers and landless laborers forming the majority audience. More males than females

reported viewing. In general, the experiment had greater impact on lower castes, illiterates, females, low income groups, and those who reported regular viewing. There were statistically significant gains in health, family planning, political information, and overall modernity. There was no measurable gain in agricultural knowledge (partly due to the region specificity of such practices).

The results of the project should be viewed in light of certain facts:

- Development of SITE hardware began in 1970, software not until 1974. The total project effort took 3,300 person years, of which 2,050 went to hardware and only 850 to software. Eighty-two percent of the costs were incurred on hardware, 9 percent on software;

- Thirty-four days before SITE broadcasts were scheduled to start, Indira Gandhi declared an Internal Emergency which involved the full censorship of all media; many of the news segments were used to transmit information on the emergency;

- An important part of the experiment's design was an attempt to dub two sound tracks on a single audio program for paired neighboring states that spoke different languages;

- The village TV set was augmented with a special antenna and a pre-amplifier converter; total cost of the set, manufactured in India, was around $1,000.

Pan-Pacific Education and Communication Experiments by Satellite (PEACESAT)

A system that became operational in 1971 for twelve participating nations, most in the Pacific Basin, PEACESAT linked remote locations to central services through the use of satellite, two-way ground terminals, teletype, blackboard-by-wire, computer, and still-frame pictures. The system was designed to augment health, education and community services. Each ground terminal linked to the satellite was operated by a government agency or regional education institutuion. The system is still in operation, and some of its earlier results include the following.

Application of the PEACESAT system provided support in the general areas of health and education, and in community service projects such as news exchange, dialogues between politicians and their constituencies, and inter-library loans. During PEACESAT's first year of operation, a plan was developed for meeting inter-library loan requests by facsimile or airmailed microfiche, thus allowing collections to be enlarged without the accompanying costs of acquisition and storage. A project providing for regional news exchange helped strengthen cooperative efforts among the participating nations, particularly in health and education, by increasing their understanding of each other's culture.

Of the various experiments conducted within the project, about one-third involved medical and health personnel. Users shared information regarding administrative planning, diagnostic consultations, public information on health education, and in-service training, with the opportunity for consultation through two-way transmission proving to be the most valuable

application. Other noteworthy results:

- During the epidemic of the dengue fever virus, the satellite link provided the opportunity to monitor progress, exchange information, transmit lab reports, and share treatment plans.

- A "Conference of PEACESAT Users," transmitted in April 1975, made possible an interim evaluation of the first four years of the project.

- Users found that links facilitated by satellite encouraged mutual confidence among participants and decreased control by outside decision makers in planning public service programs.[3]

Appalachian Education Satellite Program (AESP)

Begun in the early 1970's when the Appalachian Regional Commission was trying to find ways to provide in-service teacher training to remote, mountainous and poor areas, the AESP combined the use of a satellite, television, video, two-way audio, face-to-face contact and print material to reach residents of thirteen Appalachian states. The program was broadened to provide undergraduate and graduate courses and short workshops in education, human resources and services, medicine and health, business and industry, and government. The program has now evolved into a commercial enterprise (see ACSN: The Learning Channel, following in this paper). Some of its earlier results were as follows.

The first phase of the AESP program offered four graduate-level education courses. Following this successful demonstration, needs assessment and program planning resulted in a greatly expanded outreach effort to provide communities with specifically targeted programming. The number of regional receiving sites increased steadily. In 1978, 1,649 persons enrolled in nine courses offered by AESP via satellite. College credit for these courses was granted by 52 colleges and universities in Appalachia. Thirty workshops were offered in which a total of 7,700 persons enrolled.

The years of successful programming with NASA's experimental satellites gave AESP the necessary experience in administration and delivery to continue its public service programming using commercial satellite. AESP's non-profit corporation, the Community Service Network (CSN), contracted for 2,000 hours per year on RCA's SATCOM-1 (approximately 30 hours per week), beginning in 1979. AESP was one of the few educational experiments to date to make the successful transfer from experimental to commercial satellite.

A new element of the delivery system was the addition of a potential 18 million viewers via the nationwide cable television network, which included 1,275 earth stations, in 1979.[3]

Satellite-based Educational Programs

There continues to be interest in this country and others in the educational applications of satellite technology. If anything, the interest seems to be growing. Over the next ten years or so, the use of conventional fixed satellite systems and direct or semidirect television or radio broadcast satellites will improve the capacity of many countries to use their

communications technologies for general economic and social development. Satellite systems may be used to supplement and enrich existing educational programs or establish new programs. No one, of course, expects satellites to replace conventional classroom education.

It may be helpful to describe briefly some of the current educational efforts that use or will use satellites.

University of the South Pacific (USP)

The University of the South Pacific first participated in a satellite-based education effort when it joined the PEACESAT project in 1972. Two years later it launched its own independent project. It serves eleven countries spread over some 11 million square miles in the Pacific. The USP Network provides material for 1,400 full-time students on the main campus in Suva, Fiji, and extension studies for another 1,300 students, more than half of whom are distributed throughout the remaining countries in the Network. The Network relies on satellite-linked audio teleconferencing to provide students with tutors and quick turnaround time on tests and assignments. Each of the nine university extension centers is linked to the main campus in Suva, where an instructor can conduct a class for local tutors and students thousands of miles distant. Anyone at any location can speak to and hear anyone at any other location by using simple microphones. Microcomputers have recently been added at each location, and slow-scan video (which transmits still-frame images that can change after a number of seconds) is in use at three sites.[1]

University of the West Indies

A satellite-based audio teleconferencing system is now being installed at the University of the West Indies that will enable the university to expand its educational services in the Caribbean. The project is one of several that have been fostered and supported by the AID Rural Satellite Program. The system links the university's three main campuses--in Jamaica, Trinidad and Barbados--with each other and with extension centers on St. Lucia and Dominica. It will be used initially for distance teaching, training, and administrative teleconferencing. Interestingly, a good part of the distance teaching applications of the system center upon courses in the social sciences and the tests students must pass to earn their bachelors' degrees in social science. In addition to the audio system, the university is considering the integration of facsimile, telewriters, computers and slow-scan television.[33]

Indonesia

In 1976, Indonesia began its Palapa satellite system. The system provides telephone, telex and telegraph services on a commercial basis to its widely-dispersed population. Recently, a new project has been initiated to address educational needs created by problems of communication, transportation, administration, lack of funds, shortages of teachers, and increasing enrollments. Here, too, the AID Rural Satellite Program has helped develop the project. Ten sites will be linked by a new audio conferencing system: eight campuses of the Eastern Islands University Association, one of its

extension centers, and the Bogor Agricultural Institute. The existing Palapa satellite will support the two audio channels, one for teleconferencing and the other for audiographics. Initially, facsimile will be used so that lecture notes and other print materials can be transmitted to all sites. Telewriters and slow-scan television may also be tested to see if they meet the universities' needs. In addition to distance teaching, the system will be used for faculty upgrading, administration and sharing of research results and library resources.[2]

Alaska

Alaska, too, has problems in delivering quality education to isolated villages and towns with a limited supply of teachers. It was an early experimenter with satellite-based delivery of education services, and now has about 100 telephone earth stations and over 100 television receiving sites. Every community of 25 or more people has satellite communication services. Alaska uses one transponder that is dedicated solely to educational television. A statewide audio conferencing network and a computer network for self-instruction are also in place. The audio conferencing network is used extensively for in-service teacher training, continuing education and program administration. One hundred twenty-five sites have conference rooms with microphones and loudspeakers. The 1983 expected use for audio conferences is 1,750 hours.

Satellite-Delivered Education in the U.S.

Within the United States there are a number of organizations that rely on satellites to deliver educational programming or experiences. One of these, ACSN: The Learning Channel, evolved from the Appalachian Education Satellite Program, discussed earlier in the paper. The Learning Channel provides a broad range of programming for adult learners. Its full daily schedule is transmitted via leased transponder to over 240 cable systems throughout the United States. Colleges and universities provide credit for courses taken by registered students, but the programming is available to anyone subscribing to a participating cable system.

A similar adult education service is provided by the PBS Adult Learning Department (ADL). Concentrating on academically accepted credit courses, ADL had well over 500 colleges and universities participating during its first year of operation (1981-'82), with more than 55,000 students enrolled in one or more of its thirteen courses. Programming is delivered via satellite to over 100 public television stations, which then broadcast the courses within their viewing areas.

While these services are primarily for delivery of programming, there are other satellite-based education services that are interactive, permitting two-way (or more) communications between users. The Public Service Satellite Consortium (PSSC) is composed of nonprofit public agencies involved in health and medicine, education, public broadcasting, library services, state telecommunications and religious communications. PSSC is most widely known for its teleconferencing services, provided through its National Satellite Network, that are tailored for

each client. It does not maintain a regular schedule, but obtains transponder time as needed and designs the communications system anew for each use. Recently, the "Campus Conference Network" has been initiated by Services by Satellite, Inc., a for-profit relative of PSSC. The Campus Conference Network will link cities in the "top 50" U.S. markets through one higher education primary affiliate in each city, providing teleconferencing services to any clients. Although educational activities are not its major focus, the CCN has some obvious access and fiscal advantages for the higher education institutions that participate.

The National University Teleconference Network (NUTN) is a coalition of more than 60 higher education institutions in the United States. NUTN uses interactive audio, satellite video, and computers in expanding continuing education programs; collaborating on instructional, research and administrative issues; providing professional development for faculty and staff; and cooperating with private industry and others on national education programs.

And of course, you have already seen and heard how the CloseUp Foundation uses the C-SPAN Network to bring government and civics-related programming to thousands of high school students in the United States.

Innovative Projects

One of the most promising approaches to the international use of communication satellites in education is a project developed by the National Committee for Internationalizing Education through Satellites (NCIES). NCIES is a United States-based group consisting of specialists in language teaching, linguistics, area studies, curriculum development, educational media, satellite telecommunication, broadcasting and communication law. This group is conducting a three-phase project to teach sophisticated applied language skills and more abstract, theoretical knowledge and concepts of culture and history across national and cultural boundaries. In addition to the NCIES group, there are a number of partner institutions in the United States and other countries: University of Pennsylvania, University of Nebraska, University of Southern California, University of Hawaii, Michigan State University, Syracuse University, Florida International University/Miami Dade Community College, Middlebury College, Universidad Iberoamericana (Mexico City), Polytechnique Institute and Channel 11 (Mexico City), Center for Advanced Means and Procedures in Education (CEMPAE) and Channel 8 (Monterrey, Mexico), Institute Tecnologico y de Estudios Superiores de Monterrey (Mexico), Preparatoria Garza Sada (Mexico), Kuwait University, and Instructional Television Center, Israel.

During the first phase of the project, NCIES developed and tested a learning systems model that would teach the applied skills and general concepts. The model projects 15-20 hours of live interactive transmission for the academic year. Three tiers of students are involved in any satellite transmission. Tiers I and II are interactive and interchangeable, each tier being half of an average size class (25-30 students) with students having approximately the same language level.

Tier I is the interactive group of 10-15 students who are on camera for 15 minutes of an hour's transmission. Tier II is the interactive off-camera group who are viewing live the exchanges between Tier I and the native speakers as they occur. Each Tier II becomes Tier I for 15

minutes in each hour's broadcast. Tier III/live consists on an average of 500 students at each university location who are at any level of language competence. These students observe the live interaction between the native speakers and the Tier I students as it is occurring. Tier III/delayed consists of an indefinite number of students who observe at a later time a videotape of the Tier I/native speaker exchanges. While Tiers I and II will have had full preparation for each transmission, the extent of preparation for both groups of Tier III students (live and delayed) would be at the option of each institution.

Normally, students from all three tiers would participate from their own classrooms. This system does not require a full two-way audio-video transmission. Using a transmission network other than full two-way audio-video--such as audio with slow-scan TV, or audio only, from the Tier I students to the native speakers--is not only technically feasible, but relatively inexpensive as well.

The model presupposes leasing a block of several hours of satellite time (the most cost efficient method; the first ten minutes of a satellite transmission are the most expensive) that would be shared equally among all the institutions participating in that transmission period. The institutions would be scheduled to transmit consecutively in the time block in a predetermined sequence. At any one location, Tiers I and II would also alternate with each other in a predetermined order. Tier III at each location, while never on camera (as are Tiers I and II at different times in the transmission), is nevertheless in an active learning mode, as has been demonstrated in Phase I testing.

The project is now into Phase II, which will run through the 1984 academic year. It will involve: longitudinal testing and evaluation of the learning systems model and the learning it produces; continued training of the participants in the model's operation; and testing of the model's capacity to teach technology-related skills. There will be both live satellite transmissions and simulations during Phase II, with the possibility of even more partners--at the secondary and postsecondary levels--joining the project. Phase III of the project will be a two-year operational demonstration of the learning system model using both United States and international satellite transmissions.[4]

The NCIES approach lends itself particularly well to subject matter that crosses national and cultural boundaries. It can involve not only students, but faculty and administrators at all participating locations, however distant they may be. It provides a way of regularizing interactions, sharing knowledge, and entering into another culture. Transmissions need not be limited to classroom interactions--it is entirely feasible to be "on location" at any other site at which audio or video equipment can be introduced. This possibility greatly expands the potential for making such transmissions rich educational experiences for all participants. The applications of the model are only limited by creativity (given, of course, the technical capability to participate as a partner in such a project to begin with).

A second project, still in the early development stages, is the Wisconsin Global Classroom Project. It is a technical and educational program that plans to allow students in Wisconsin direct communication with students in several areas of the world. Through the use of communication satellites, students will benefit from opportunities in culture and language study, international economics and politics, and world issues, and will be able to obtain direct information and opinions from across the world.

The program design includes a "satellite semester" where American students will talk directly and on a regular basis with their counterparts in countries such as Japan, India, Nigeria, Mexico, and England. Students will see and discuss world issues with scholars and other students. Regular lectures and seminars as well as "informal" discussions will be part of the satellite semester. In addition to discussions on such topics as contemporary and future markets and jobs, politics and recreation, students will have computers available for their use in exchanging data and investigating and playing simulations and games. Program support components will include two-way television and radio.

While the initial involvement will be with one high school in Milwaukee, Wisconsin, all students in the state will have access to the satellite semester by sending teams of students to Milwaukee, as well as via closed circuit television, local satellite earth stations, cable television, radio, videotape, telephone, and print materials. A program coordinator will teach the satellite semester and provide inservice opportunities for teachers, students, and community people interested in international exchanges and understanding.

Conclusion

This brief paper has presented an overview of some of the organizations and institutions and projects involved in the educational use of satellite communications. It is intended to provide a beginning point for helping conference participants to think about the potential of satellite telecommunications for achieving some of their institutional and personal educational goals. By providing examples of other educational activities that have already been implemented, the author hopes to encourage the conceptualizing of other new, perhaps innovative uses of the technology that will serve students and their teachers wherever they may be.

It should also be recognized that this paper has dealt with satellite telecommunications as a tool for educators to use as they deem appropriate. The paper has not dealt with--but social scientists must become involved with, in their thinking, researching and teaching--the implications of satellite telecommunication for individuals, cultures and our global society as a whole.

Attached is a list of organizations and their addresses for those who wish to obtain more information about activities mentioned in the paper. The author will be pleased to discuss other information sources with anyone wishing to contact him: Paul Schneller, 420 South Woodlawn Avenue, Bloomington, Indiana 47401. 812/332-2901.

Figure 1.

SATELLITE SYSTEMS

International Satellite Systems	Current Status
INTELSAT Global Satellite System	Operational (currently 16 satellites)
INMARSAT Maritime Mobile Satellite System	Operational (4 satellites)
INTERSPUTNIK Satellite System	Operational (leased capacity from USSR)
Regional Satellites System	
Arabsat Satellite System	1985 Launch
African Satellite System	Under consideration only.
EUTELSAT Satellite System	To be fully operational 1983-84.
Palapa Satellite System	Indonesia Domestic System, regional services.
Domestic Satellite Systems - Dedicated Systems	
Australian National Satellite Systems (AUSSAT)	Under construction for 1985 launch.
Brazilian Domestic Satellite System (BRAZILSAT)	Under construction for 1985 launch.
Canadian Domestic Satellite System (ANIK A-D)	Operational
China Domestic Satellite System	Project cancelled.
Colombia Domestic Satellite System (SATCOL)	Contract award under consideration.
French Domestic Digital Satellite System (TELECOM)	Under construction for 1985 launch.
French DBS Satellite (T.D.F)	Under construction for 1986 launch.
Germany (Fed. Rep. of) Domestic Digital and TV Distribution Satellite	Planned for 1987 or 1988.
Germany (Fed. Rep. of) DBS Satellite (TV-Sat)	Planned for 1985.
Indian Satellite System (INSAT)	Operational (Temporarily out of service).
Indonesian Satellite System (Palapa A & B)	Operational.
Iranian Satellite System (Zahreh)	Project cancelled.
Italian Satellite System (Italsat)	Planned for 1986.
Italian DBS Satellite System (SARIT)	Planned for 1985
Japanese Domestic Satellite System (CS-2a, 2b)	Planned for 1983.
Japanese Domestic Broadcast System (BS-2a, 2b)	Planned for 1985.
Luxembourg Domestic Broadcasting System (LUXSAT)	Planned for 1986.
Mexican Domestic Satellite System (SATMEX)	Status uncertain.
Saudi Arabian Broadcast Satellite System (SABS)	Planned for 1986.
Swedish Domestic Satellite System (Tele-X)	Planned for 1986.
Switzerland Domestic B.cast Satellite (Helvesat)	Planned for 1986.
United Kingdom Domestic (UNISAT)	Planned for 1986.

Figure 1. Satellite Systems

Domestic Satellite Systems - Dedicated Systems
(Continued)

United States Domestic Satellite Systems	Current Status
Advanced Business Communications, Inc. (ABCI)	Planned for late 1980's.
American Satellite Company System	Operational.
Comstar Satellite System	Operational.
CBS Satellite Systems	Planned for mid-1980's.
Direct Broadcast Satellite Corporation	Planned for mid-1980's.
Graphic Scanning Satellite System	Planned for mid-1980's.
GT & E Satellite System (G-Star)	Planned for 1984.
Hughes Galaxy Satellite System	Planned for 1983.
Oak Satellite System	Planned for mid-1980's.
RCA DBS Satellite System	Planned for mid-1980's.
RCA Satcom Satellite System	Operational.
Satellite Business System (IMB/Comsat)	Operational.
Southern Pacific Communications Corp. (SPACENET)	Planned for 1985.
Satellite Television Corp. (Comsat)	Planned for 1985.
Telstar Satellite System (AT & T)	Planned for 1984.
Tracking, Data, Relay Satellite/Advanced Westar (NASA/Western Union)	Planned for mid-1983.
United Satellite Services Broadcasting (Hubbard)	Planned for mid-1980's.
U.S. Satellite System, Inc	Planned for mid-1980's.
Video Satellite System	Planned for mid-1980's.
Western Union Satellite System	Operational.
Western Union DBS Satellite System	Planned for mid-to-late 1980's.
U.S.S.R Domestic Satellite Systems	
Ekran Broadcast Satellite System	Operational.
Loutch Satellite System	Operational.
Molnya Satellite System	Operational.
Raduga Satellite System	Operational.
Volna Satellite System	Planned for 1984.

Domestic Satellite Systems - (Leased/Shared Use Systems)

Algerian Satellite System	Operational.
Angolan Satellite	Planned for 1983.
Argentina Satellite System	Operational.
Australia Satellite System	Operational.
Bangladesh Satellite System	Planned for 1984.
Bolivian Satellite System	Planned for 1983.
Brazilian Satellite System	Operational.
Cameroon Satellite System	Planned for 1984.
Chilean Satellite System	Operational.
China Satellite System	Planned for 1983.
Colombian Satellite System	Planned for 1983.
Denmark (Greenland) Satellite System	Operational.

Figure 1. Satellite Systems

Domestic Satellite Systems - (Leased/Shared Use Systems (Continued)	Current Status
Ecuadorian Satellite System	Planned for 1983.
France Overseas Territory (Reunion, Martinique) Satellite System	Operational.
Germany (Fed. Rep. of) Satellite System Spot Beam 14/11 GHz	Planned for 1984.
Indian Satellite System	Operational.
Korean (Rep. of) Satellite System)	Planned for 1986.
Libyan Satellite System	Operational.
Malaysian Satellite System	Operational.
Mali Satellite System	Planned for 1983.
Mauritanian Satellite System	Planned for 1983.
Mexican Satellite System	Operational.
Moroccan Satellite System	Operational.
Niger Satellite System	Operational.
Nigerian Satellite System	Operational.
Norwegian Satellite System	Operational.
Oman Satellite System	Operational.
Pakistan Satellite System	Planned for 1983.
Papua, New Guinea, Satellite System	Planned for 1985.
Peruvian Satellite System	Operational.
Philippine Satellite System	Operational.
Portugal (Azores) Satellite System	Operational.
Saudi Arabia Satellite System	Operational.
South Africa Satellite System	Planned for 1983.
Spain (Canary Islands) Satellite System	Operational.
Sri Lanka Satellite System	Planned for 1985.
Sudan Satellite System	Operational
Thailand Satellite System	Planned for 1983.
United Kingdom (Offshore Service) Satellite System	Planned for 1983.
Venezuelan Satellite System	Planned for 1983
Zairean Satellite System	Operational.
Military Satellites Systems	
NATO Military Satellite Communications Project	Operational.
U.K. Skynet Defense Communications Network	Operational.
U.S. Military Satellite Communications Network	
U.S.A.F Communications Satellite System	Operational.
U.S. Defense Satellite Communications System	Operational.
U.S. Naval Satellite Communications System	Operational.
U.S. Fleetsatcom Communications System	Operational.

Figure 1. Satellite Systems

Military Satellite Systems (Continued)

U.S.S.R. Military Communications Satellite System	Current Status
Cosmos Military Satellite System	Operational.
GALS Military Satellite System	Operational.
Volna Naval Communications Satellite System	Planned 1984.

Experimental Satellite Systems

Applications Technological Satellites, U.S. NASA	Operational.
Canadian Experimental Mobile Satellite Program, Canadian Government	Planned for 1988.
Communications Technology Satellite, U.S./Canada	Out of service.
European Mobile Communications Satellite, E.S.A.	Planned for 1987.
Japanese Experimental Broadcast Satellite, NASADA (GE)	Planned for 1987.
Japanese Experimental Communications Satellite, NASADA (FACC)	Operational
Lincoln Experimental Satellite Project, U.S. DOD	Out of service.
U.S. Mobile Satellite Experiment Program, NASA	Planned for late 1980's.
NASA Advanced Technologies Satellite Experiment, 20/30 GHz	Planned for late 1980's.
NASA Experimental Prototype Space Platform	Planned for late 1980's.
Orbital Test Satellite, E.S.A. Experimental Sat.	Operational.
Sirio Experimental Communications Satellite, Italian	Operational.
Symphonie Experimental Communications Satellite, French/German	Operational.
TACSATCOM Experimental Military Satellite, U.S. Military	Out of service.

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